

Performance of positive ion based high power ion source of EAST neutral beam injector

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A positive ion based source was developed for a high power neutral beam injector (NBI) on the Experimental Advanced Superconducting Tokamak (EAST)¹⁻⁵. The ion source contains a bucket hot cathode arc chamber with 650 mm long, 260 mm width and 300 mm depth. There are 32 hairpin filaments with diameter of 1.5 mm and 160 mm long to supply primary electrons. A tetrode type accelerator with slit type used to extract the ions from the plasma and accelerated to the desired energy. The beam extraction area is 120 mm × 480 mm with beam transmittance of 60 %. The designed beam species is deuterium with beam power of 2-4 MW and beam energy of 50-80 keV and beam pulse length of 10-100 s.

There are 5 ion sources was developed so far. They most have the same structure. The ion sources need to be conditioned and performance tested on the test bead before installed on the EAST-NBI. The hydrogen was used for the test and each ion source needs to deliver 4 MW beam power with beam energy of 80 keV. The optimum beam perveance is $2.8 \mu p$ with beam energy of 50 keV. Long pulse beam extraction also tested to achieve 100 s on the test bed. Consider the high power deposited on the calorimeter, the beam was modulated with suitable frequency and duty ratio. When the conditioning finished, the ion sources were moved to the EAST-NBI. The deuterium beam was extracted and injected into the EAST plasma. Details of the performance of positive ion source on the test bad and EAST-NBI will be presented.

References

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